2. Subbasin Assessment – Water Quality Concerns and Status

The Kootenai River and most of its tributaries in the basin are not listed as water quality limited under Subsection 303(d) of the Clean Water Act. Seven stream segments in the Lower Kootenai and Moyie River Subbasins are listed under Subsection 303(d) of the CWA 1998 Idaho list. Streams that have been assessed and found to be supporting beneficial uses, and therefore not §303(d) listed, are shown in Table 4.

Table 4. Lower Kootenai River and Moyie River Subbasin beneficial uses of streams assessed but non-listed on the 1998 §303(d) list.

Water Body	Assessment Unit	Uses[a]	Type of Use
Callahan Creek	ID17010104PN0	CWAL, PCR	Presumed
Long Canyon Creek	ID17010104PN008_02	CWAL, SS, PCR	Designated
Mission Creek	ID17010104PN038_02 ID17010104PN038_03	CWAL, SS	Designated
Myrtle Creek	ID17010104PN013_02 ID17010104PN013_03	CWAL, SS, PCR	Designated
Parker Creek	ID17010104PN009_02 ID17010104PN009_03	CWAL, SS, PCR	Designated
Ruby Creek	ID17010104PN020_02 ID17010104PN020_03	CWAL, SS, PCR	Designated
Smith Creek	ID17010104PN0	CWAL, SS, PCR	Designated
Placer Creek	ID17010104PN0	CWAL, PCR	Presumed

[a] CWAL – cold water aquatic life, SS – salmonid spawning, PCR – primary contact recreation, SCR – secondary contact recreation, AWS – agricultural water supply, DWS – domestic water supply

2.1. Water Quality Limited Assessment Units Occurring in the Subbasin

Subsection 303(d) of the CWA states that waters that are unable to support their beneficial uses and that do not meet water quality standards must be listed as water quality limited waters. Subsequently, these waters are required to have TMDLs developed to bring them into compliance with water quality standards.

The Lower Kootenai and Moyie River Subbasins have a total of six water quality limited stream segments on the 1998 §303(d) list for sediment, one for metals, one for pH, and two for temperature. These are shown in Table 5.

Table 5. 1998 §303(d) Segments in the Lower Kootenai and Moyie River Subbasins.

Water Body Name	Assessment Unit ID Number	1998 §303(d) Boundaries	Pollutants	Listing Basis
Boulder Creek	ID17010104PN032_03	Headwaters to Kootenai River	Sediment	Unknown
Deep Creek	ID17010104PN015_04	McAurthur Lake to Kootenai River	Sediment, Temp	EPA addition
Blue Joe Creek	ID17010104PN004_02	Headwaters to Canadian border	Sediment, Metals., pH	Unknown

Caribou Creek	ID17010104PN017_02	Headwaters to Snow Creek	Sediment	Unknown
Cow Creek	ID17010104PN006_03	Headwaters to Smith Creek	Sediment	Unknown
Boundary Creek	ID17010104PN002_03	Canadian/Idaho border to Kootenai River	Temp	EPA addition
Moyie River	ID17010105PN001_05	Moyie Falls dam to Kootenai River	Sediment	Unknown

The 2002 Integrated Report (formally known as the §303(d) list) includes numerous additional waterbodies listed for temperature criteria exceedances. These segments are shown in Figure 19 and listed in Table 6, including their segment ID numbers, designated boundaries, and listed pollutants.

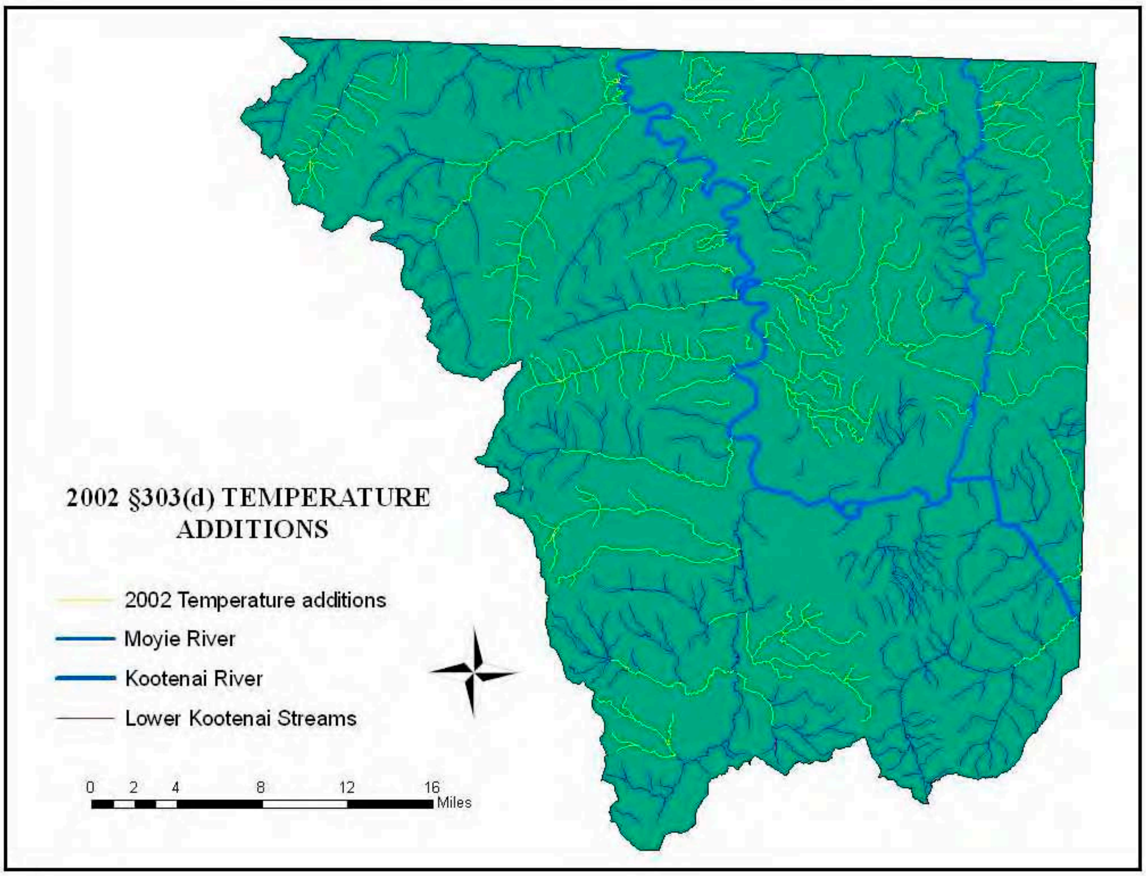

Figure 19. Streams added to the 2002 §303(d) list for temperature.

Table 6. 2002 additions to the 1998 §303(d) list.

Stream Name	Assessment Unit ID number	2002 §303(d) Boundaries	Listed Pollutants
Ball Creek	ID17010104PN011_02	Source to mouth	Temperature
Boulder Creek	ID17010104PN032_03	East Fork Boulder Creek to mouth	Temperature, siltation
Brown Creek	ID17010104PN027_02	Source to mouth	Temperature

Stream Name	Assessment Unit ID number	2002 §303(d) Boundaries	Listed Pollutants
Caribou Creek	ID17010104PN017_02	Source to mouth	Temperature, suspended solids, siltation
Caribou Creek	ID17010104PN016_03	Source to mouth	Temperature
Cow Creek	ID17010104PN006_03	Source to mouth	Temperature, suspended solids, siltation
Curley Creek	ID17010104PN035_03	Source to mouth	Temperature
Dodge Creek	ID17010104PN024_02	Source to mouth	Temperature
Dodge Creek	ID17010104PN024_04	Source to mouth	Temperature
Fall Creek	ID17010104PN021_03	Source to mouth	Temperature, causes unknown
Fisher Creek	ID17010104PN001_02	Shorty’s Island to Idaho/Canadian border	Temperature
Fleming Creek	ID17010104PN036_02	Source to mouth	Temperature
Fleming Creek	ID17010104PN036_03	Source to mouth	Temperature
Grass Creek	ID17010104PN003_02	Source to Idaho/Canadian border	Temperature
Long Canyon Creek	ID17010104PN008_02	Source to mouth	Temperature
Mission Creek	ID17010104PN038_03	Brush Creek to mouth	Temperature
Mission Creek	ID17010104PN040_03	Idaho/Canadian border to Brush Creek	Temperature
Myrtle Creek	ID17010104PN013_03	Source to mouth	Temperature
Parker Creek	ID17010104PN009_03	Source to mouth	Temperature
Rock Creek	ID17010104PN037_02	Source to mouth	Temperature
Rock Creek	ID17010104PN037_03	Source to mouth	Temperature
Ruby Creek	ID17010104PN020_03	Source to mouth	Temperature
Smith Creek	ID17010104PN005_04	Cow Creek to mouth	Temperature
Smith Creek	ID17010104PN007_03	Source to Cow Creek	Temperature
Snow Creek	ID17010104PN016_02	Source to mouth	Temperature
Snow Creek	ID17010104PN016_03	Source to mouth	Temperature
Trail Creek	ID17010104PN026_03	Source to mouth	Temperature
Trout Creek	ID17010104PN010_03	Source to mouth	Temperature
Twentymile Creek	ID17010104PN027_03	Source to mouth	Temperature
Twentymile Creek	ID17010104PN028_02	Source to mouth	Temperature
Blue Joe Creek	ID17010105PN004_02	Source to Idaho/Canadian border	Temperature
Brass Creek	ID17010105PN006_02	Idaho/Canadian border to Round Prairie Creek	Temperature
Canuck Creek	ID17010105PN007_02	Idaho/Montana border to Idaho/Canadian border	Temperature
Copper Creek	ID17010105PN006_02	Idaho/Canadian border to Round Prairie Creek	Temperature
Deer Creek	ID17010105PN003_02	Source to mouth	Temperature
Deer Creek	ID17010105PN004_03	Source to mouth	Temperature
Faro Creek	ID17010105PN004_02	Source to mouth	Temperature
Gillon Creek	ID17010105PN009_02	Idaho/Canadian border to mouth	Temperature
Keno Creek	ID17010105PN004_02	Source to mouth	Temperature
Meadow Creek	ID17010105PN012_03	Source to mouth	Temperature
Miller Creek	ID17010105PN011_02	Source to mouth	Temperature
Placer Creek	ID17010105PN002_02	Meadow Creek to Moyie Falls Dam	Temperature
Round Prairie Creek	ID17010105PN010_03	Source to Gillon Creek	Temperature

Stream Name	Assessment Unit ID number	2002 §303(d) Boundaries	Listed Pollutants
Skin Creek	ID17010105PN003_02	Idaho/Montana border to mouth	Temperature
Skin Creek	ID17010105PN003_02	Idaho/Montana border to mouth	Temperature
Spruce Creek	ID17010105PN006_02	Idaho/Canadian border to Round Prairie Creek	Temperature, causes unknown
Wall Creek	ID17010105PN012_02	Source to mouth	Temperature
West Fork Deer Creek	ID17010105PN004_02	Source to mouth	Temperature

2.1.1. About Assessment Units

Assessment units (AUs) now define all the waters of the state of Idaho. These units and the methodology used to describe them can be found in the *Water Body Assessment Guidance*, second edition (WBAG II) (Grafe et al. 2002).

Assessment units are groups of similar streams that have similar land use practices, ownership, or land management. Stream order, however, is the main basis for determining AUs—although ownership and land use can change significantly over time, the AU remains the same.

Using assessment units to describe water bodies offers many benefits, the primary benefit being that all the waters of the state are now defined consistently. In addition, using AUs fulfills the fundamental requirement of EPA's §305(b) report, a component of the Clean Water Act wherein states report on the condition of all the waters of the state. Because AUs are a subset of water body identification numbers, there is now a direct geo-referenced tie to the water quality standards for each AU, so that beneficial uses defined in the water quality standards are clearly tied to streams on the landscape.

However, the new framework of using AUs for reporting and communicating needs to be reconciled with the legacy of §303(d) listed streams. Due to the nature of the court-ordered 1994 §303(d) listings, and the subsequent 1998 §303(d) list, all segments were added with boundaries from "headwaters to mouth." In order to deal with the vague boundaries in the listings, and to complete TMDLs at a reasonable pace, DEQ began developing TMDLs at the watershed scale (HUC), so that all the waters in the drainage are being or have been considered for TMDL purposes since 1994.

The boundaries from the 1998 §303(d) listed segments have been transferred to the new AU framework, using an approach quite similar to the way DEQ has been writing SBAs and TMDLs. All AUs contained in the listed segment were carried forward to the 2002 §303(d) listings in Section 5 of the Integrated Report. AUs not wholly contained within a previously listed segment, but partially contained (even minimally), were also included on the §303(d) list. This was necessary to maintain the integrity of the 1998 §303(d) list and to maintain continuity with the TMDL program. These new AUs will lead to better assessment of water quality listing and de-listing.

When assessing new data that indicate full support, only the AU that the monitoring data represents will be removed (de-listed) from the §303(d) list (Section 5 of the Integrated Report).

2.1.2. Listed Waters

Table 5 shows the pollutants listed and the basis for listing for each §303(d) listed AU in the subbasin. Not all of these water bodies will require a TMDL, which has been discussed in Section 1.2.4 Stream Characteristics. However, a thorough investigation, using the available data, was performed before this conclusion was made. This investigation, along with a presentation of the evidence of non-compliance with standards for several other tributaries, is contained in the following sections.

2.2. Applicable Water Quality Standards

The water quality standards designate beneficial uses and set water quality goals for the waters of the state. The designated uses for the Idaho portions of the Lower Kootenai and Moyie River Subbasins appear below.

2.2.1. Beneficial Uses

Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses as briefly described in the following paragraphs. The WBAG II (Grafe et al. 2002) gives a more detailed description of beneficial use identification for use assessment purposes.

2.2.1.1. Existing Uses

Existing uses under the CWA are "those uses actually attained in the waterbody on or after November 28, 1975, whether or not they are included in the water quality standards." The existing in-stream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.050.02, .02.051.01, and .02.053). Existing uses include uses actually occurring, whether or not the level of quality to fully support the uses exists. A practical application of this concept would be to apply the existing use of salmonid spawning to a water that could support salmonid spawning, but salmonid spawning is not occurring due to other factors, such as dams blocking migration.

2.2.1.2. Designated Uses

Designated uses under the CWA are "those uses specified in water quality standards for each water body or segment, whether or not they are being attained." Designated uses are simply uses officially recognized by the state. In Idaho these include uses such as aquatic life support, recreation in and on the water, domestic water supply, and agricultural uses. Water quality must be sufficiently maintained to meet the most sensitive use. Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not be to preclude protection of an existing higher quality use such as cold water aquatic life or salmonid spawning. Designated uses are specifically listed for water bodies in Idaho in tables in the Idaho water quality standards (see IDAPA 58.01.02.003.27 and .02.109-.02.160 in addition to citations for existing uses).

2.2.1.3. Presumed Uses

In Idaho, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations. These undesignated uses are to be designated. In the interim, and absent information on existing uses, DEQ presumes that most waters in the state will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called "presumed uses," DEQ will apply the numeric cold water criteria and primary or secondary contact recreation criteria to undesignated waters. If, in addition to these presumed uses, an additional existing use, (e.g., salmonid spawning) exists, because of the requirement to protect levels of water quality for existing uses, then the additional numeric criteria for salmonid spawning would also apply (e.g., intergravel dissolved oxygen, temperature). However, if for example, cold water aquatic life is not found to be an existing use, a use designation to that effect is needed before some other aquatic life criteria (such as seasonal cold) can be applied in lieu of cold water criteria (IDAPA 58.01.02.101.01).

Beneficial uses for §303(d) listed watersheds in the Lower Kootenai and Moyie River Subbasins are listed in Table 7. A complete list of beneficial uses in the subbasins can be found in the Idaho water quality standards.

Table 7. Lower Kootenai and Moyie River Subbasins beneficial uses of §303(d) listed streams.

Water Body	Assessment Unit	Uses[a]	Type of Use
Boulder Creek- Headwaters to Kootenai River	ID17010104PN032_03 ID17010104PN033_02 ID17010104PN033_03	CWAL, SS, PCR	Designated
Deep Creek- McArthur Lake to Kootenai River	ID17010104PN025_02 ID17010104PN025_03 ID17010104PN019_04 ID17010104PN018_04 ID17010104PN015_04	CWAL, SS, PCR, DWS, SRW	Designated
Blue Joe Creek- Headwaters to Canadian border	ID17010104PN004_02	CWAL, SS, PCR	Designated
Caribou Creek- Headwaters to Snow Creek	ID17010104PN017_02	CWAL, SS, PCR	Designated
Cow Creek- Headwaters to Smith Creek	ID17010104PN006_02 ID17010104PN006_03	CWAL, SS, PCR	Designated
Boundary Creek- Idaho/Canadian border to Idaho/Canadian border	ID17010104PN002_02 ID17010104PN002_03	CWAL, SS, PCR	Designated
Moyie River- Moyie Falls dam to Kootenai River	ID17010105PN001_05	CWAL, SS, PCR, DWS, SRW	Designated

[a] CWAL – cold water aquatic life, SS – salmonid spawning, PCR – primary contact recreation, SCR – secondary contact recreation, AWS – agricultural water supply, DWS – domestic water supply, SRW – special resource water

2.2.2. Criteria to Support Beneficial Uses

Beneficial uses are protected by a set of criteria, which include *narrative* criteria for pollutants such as sediment and nutrients and *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity (IDAPA 58.01.02.250) (Table 8).

Excess sediment is described by narrative criteria (IDAPA 58.01.02.200.08): "Sediment shall not exceed quantities specified in Sections 250 and 252 or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determinations of impairment shall be based on water quality monitoring and surveillance and the information utilized as described in Subsection 350."

Narrative criteria for excess nutrients are described in IDAPA 58.01.02.200.06, which states: “Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses.”

Narrative criteria for floating, suspended, or submerged matter are described in IDAPA 58.01.02.200.05, which states: “Surface waters of the state shall be free from floating, suspended, or submerged matter of any kind in concentrations causing nuisance or objectionable conditions or that may impair designated beneficial uses. This matter does not include suspended sediment produced as a result of nonpoint source activities.”

DEQ’s procedure to determine whether a water body fully supports designated and existing beneficial uses is outlined in IDAPA 58.01.02.053. The procedure relies heavily upon biological parameters and is presented in detail in the WBAG II (Grafe et al. 2002). This guidance requires the use of the most complete data available to make beneficial use support status determinations.

Table 8 includes the most common numeric criteria used in TMDLs. Figure 20 provides an outline of the stream assessment process for determining support status of the beneficial uses of cold water aquatic life, salmonid spawning, and contact recreation.

Table 8. Selected numeric criteria supportive of designated and existing beneficial uses in Idaho water quality standards.

Designated and Existing Beneficial Uses				
Water Quality Parameter	**Primary Contact Recreation**	**Secondary Contact Recreation**	**Cold Water Aquatic Life**	**Salmonid Spawning (During Spawning and Incubation Periods for Inhabiting Species)**
Water Quality Standards: IDAPA 58.01.02.250				
Bacteria, pH, and Dissolved Oxygen (DO)	Less than 126 *E. coli*/100 ml[a] as a geometric mean of five samples over 30 days; no sample greater than 406 *E. coli* organisms/100 ml	Less than 126 *E. coli*/100 ml as a geometric mean of five samples over 30 days; no sample greater than 576 *E. coli*/100 ml	pH between 6.5 and 9.0 DO[b] exceeds 6.0 mg/L[c]	pH between 6.5 and 9.5 Water Column DO: DO exceeds 6.0 mg/L in water column or 90% saturation, whichever is greater Intergravel DO: DO exceeds 5.0 mg/L for a one day minimum and exceeds 6.0 mg/L for a seven day average

Designated and Existing Beneficial Uses				
Water Quality Parameter	**Primary Contact Recreation**	**Secondary Contact Recreation**	**Cold Water Aquatic Life**	**Salmonid Spawning (During Spawning and Incubation Periods for Inhabiting Species)**
Temperature[d]			22 °C or less daily maximum; 19 °C or less daily average	13 °C or less daily maximum; 9 °C or less daily average Bull trout: not to exceed 13 °C maximum weekly maximum temperature over warmest 7-day period, June – August; not to exceed 9 °C daily average in September and October
			Seasonal Cold Water: Between summer solstice and autumn equinox: 26 °C or less daily maximum; 23 °C or less daily average	
Turbidity			Turbidity shall not exceed background by more than 50 NTU[e] instantaneously or more than 25 NTU for more than 10 consecutive days.	
Ammonia			Ammonia not to exceed calculated concentration based on pH and temperature.	
EPA Bull Trout Temperature Criteria: Water Quality Standards for Idaho, 40 CFR Part 131				
Temperature				7 day moving average of 10 °C or less maximum daily temperature for June - September

[a] *Escherichia coli* per 100 milliliters
[b] dissolved oxygen
[c] milligrams per liter
[d] Temperature Exemption - Exceeding the temperature criteria will not be considered a water quality standard violation when the air temperature exceeds the ninetieth percentile of the seven-day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather reporting station.
[e] Nephelometric turbidity units

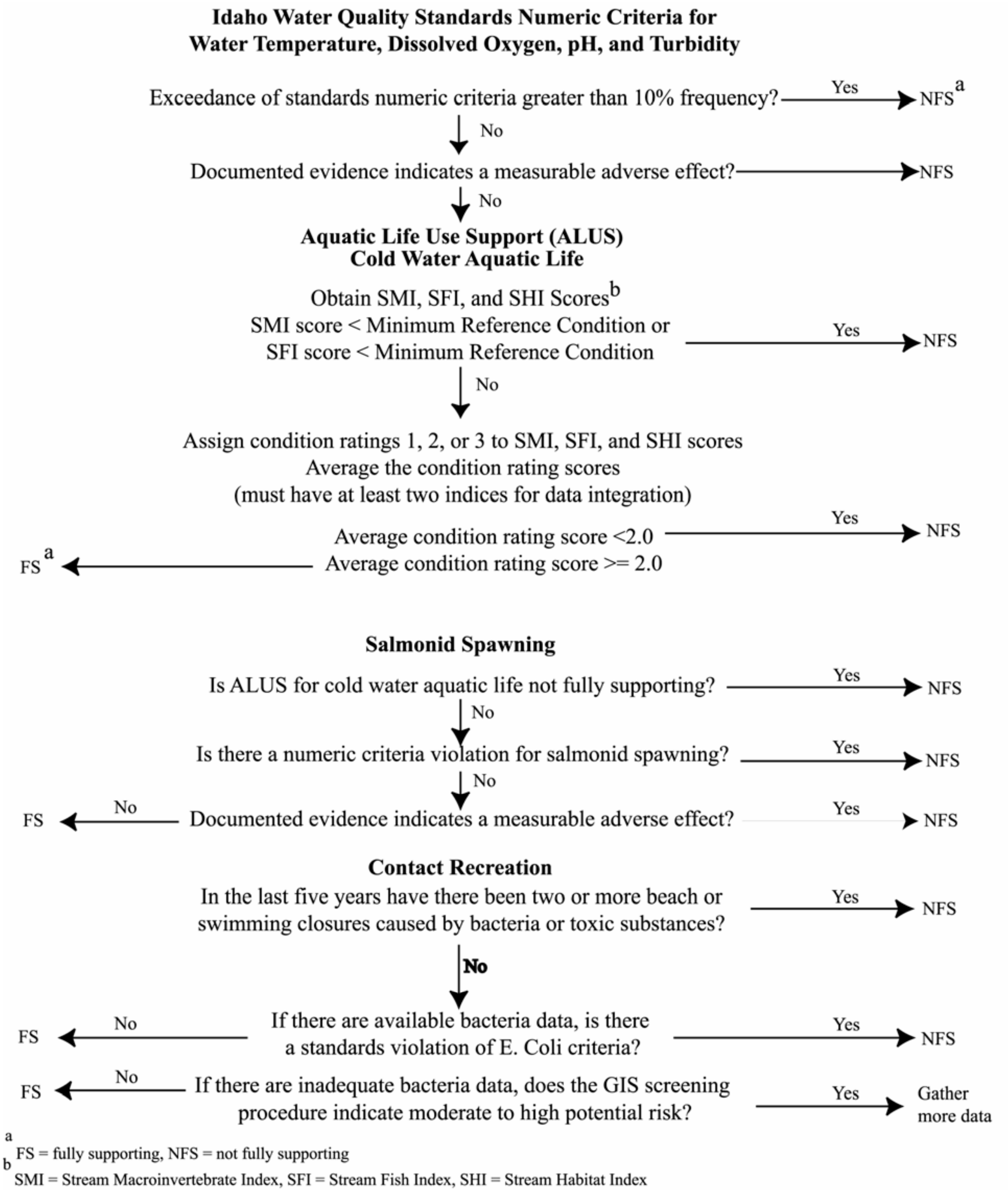

Figure 20. Determination Steps and Criteria for Determining Support Status of Beneficial Uses in Wadeable Streams: Water Body Assessment Guidance, Second Edition (Grafe et al. 2002).

2.3. Pollutant/Beneficial Use Support Status Relationships

Most of the pollutants that impair beneficial uses in streams are naturally occurring stream characteristics that have been altered by humans. That is, streams naturally have sediment, nutrients, and the like, but when anthropogenic sources cause these to reach unnatural levels, they are considered "pollutants" and can impair the beneficial uses of a stream.

2.3.1. Temperature

Temperature is a water quality factor integral to the life cycle of fish and other aquatic species. Different temperature regimes also result in different aquatic community compositions. Water temperature dictates whether a warm, cool, or cold water aquatic community is present. Many factors, natural and anthropogenic, affect stream temperatures. Natural factors include altitude, aspect, climate, weather, riparian vegetation (shade), and channel morphology (width and depth). Human influenced factors include heated discharges (such as those from point sources), riparian alteration, channel alteration, and flow alteration.

Elevated stream temperatures can be harmful to fish at all life stages, especially if they occur in combination with other habitat limitations such as low dissolved oxygen or poor food supply. Acceptable temperature ranges vary for different species of fish, with cold water species being the least tolerant of high water temperatures. Temperature as a chronic stressor to adult fish can result in reduced body weight, reduced oxygen exchange, increased susceptibility to disease, and reduced reproductive capacity. Acutely high temperatures can result in death if they persist for an extended length of time. Juvenile fish are even more sensitive to temperature variations than adult fish, and can experience negative impacts at a lower threshold value than the adults, manifesting in retarded growth rates. High temperatures also affect embryonic development of fish before they even emerge from the substrate. Similar kinds of effects may occur to aquatic invertebrates, amphibians and mollusks, although less is known about them.

2.3.2. Dissolved Oxygen

Oxygen is necessary for the survival of most aquatic organisms and essential to stream purification. Dissolved oxygen (DO) is the concentration of free (not chemically combined) molecular oxygen (a gas) dissolved in water, usually expressed in milligrams per liter (mg/L), parts per million, or percent of saturation. While air contains approximately 20.9% oxygen gas by volume, the proportion of oxygen dissolved in water is about 35%, because nitrogen (the remainder) is less soluble in water. Oxygen is considered to be moderately soluble in water. A complex set of physical conditions that include atmospheric and hydrostatic pressure, turbulence, temperature, and salinity affect the solubility.

Dissolved oxygen levels of 6 mg/L and above are considered optimal for aquatic life. When DO levels fall below 6 mg/L, organisms are stressed, and if levels fall below 3 mg/L for a prolonged period, these organisms may die; oxygen levels that remain below 1-2 mg/L for a few hours can result in large fish kills. Dissolved oxygen levels below 1 mg/L are often referred to as hypoxic; anoxic conditions refer to those situations where there is no measurable DO.

Juvenile aquatic organisms are particularly susceptible to the effects of low DO due to their high metabolism and low mobility (they are unable to seek more oxygenated water). In addition, oxygen is necessary to help decompose organic matter in the water and bottom sediments. Dissolved oxygen reflects the health or the balance of the aquatic ecosystem.

Oxygen is produced during photosynthesis and consumed during plant and animal respiration and decomposition. Oxygen enters water from photosynthesis and from the atmosphere. Where water is more turbulent (e.g., riffles, cascades), the oxygen exchange is greater due to the greater surface area of water coming into contact with air. The process of oxygen entering the water is called aeration.

Water bodies with significant aquatic plant communities can have significant DO fluctuations throughout the day. An oxygen sag will typically occur once photosynthesis stops at night and respiration/decomposition processes deplete DO concentrations in the water. Oxygen will start to increase again as photosynthesis resumes with the advent of daylight.

Temperature, flow, nutrient loading, and channel alteration all impact the amount of DO in the water. Colder waters hold more DO than warmer waters. As flows decrease, the amount of aeration typically decreases and the in-stream temperature increases, resulting in decreased DO. Channels that have been altered to increase the effectiveness of conveying water often have fewer riffles and less aeration. Thus, these systems may show depressed levels of DO in comparison to levels before the alteration. Nutrient enriched waters have a higher biochemical oxygen demand due to the amount of oxygen required for organic matter decomposition and other chemical reactions. This oxygen demand results in lower instream DO levels.

2.3.3. Sediment

Both suspended (floating in the water column) and bedload (moves along the stream bottom) sediment can have negative effects on aquatic life communities. Many fish species can tolerate elevated suspended sediment levels for short periods of time, such as during natural spring runoff, but longer durations of exposure are detrimental. Elevated suspended sediment levels can interfere with feeding behavior (difficulty finding food due to visual impairment), damage gills, reduce growth rates, and in extreme cases eventually lead to death.

Newcombe and Jensen (1996) reported the effects of suspended sediment on fish, summarizing 80 published reports on streams and estuaries. For rainbow trout, physiological stress, which includes reduced feeding rate, is evident at suspended sediment concentrations of 50 to 100 mg/L when those concentrations are maintained for 14 to 60 days. Similar effects are observed for other species, although the data sets are less reliable. Adverse effects on habitat, especially spawning and rearing habitat presumably from sediment deposition, were noted at similar concentrations of suspended sediment.

Organic suspended materials can also settle to the bottom and, due to their high carbon content, lead to low intergravel DO through decomposition.

In addition to these direct effects on the habitat and spawning success of fish, detrimental changes to food sources may also occur. Aquatic insects, which serve as a primary food source for fish, are affected by excess sedimentation. Increased sedimentation leads to a macroinvertebrate community that is adapted to burrowing, thereby making the macroinvertebrates less available to fish. Community structure, specifically diversity, of the aquatic macroinvertebrate community is diminished due to the reduction of coarse substrate habitat.

Settleable solids are defined as the volume (milliliters [ml]) or weight (mg) of material that settles out of a liter of water in one hour (Franson et al. 1998). Settleable solids may consist of large silt, sand, and organic matter. Total suspended solids (TSS) are defined as the material collected by filtration through a 0.45-µm (micrometer) filter (Standard Methods 1975, 1995). Settleable solids and TSS both contain nutrients that are essential for aquatic plant growth. Settleable solids are not as nutrient rich as the smaller TSS, but they do affect river depth and substrate nutrient availability for macrophytes. In low flow situations, settleable solids can accumulate on a stream bottom, thus decreasing water depth. This increases the area of substrate that is exposed to light, facilitating additional macrophyte growth.

2.3.4. Sediment – Nutrient Relationship

The linkage between sediment and sediment-bound nutrients is important when dealing with nutrient enrichment problems in aquatic systems. Phosphorus is typically bound to particulate matter in aquatic systems and, thus, sediment can be a major source of phosphorus to rooted macrophytes in the water column. While most aquatic plants are able to absorb nutrients over the entire plant surface due to a thin cuticle (Denny 1980), bottom sediments serve as the primary nutrient source for most sub-stratum attached macrophytes. The USDA (1999) determined that other than harvesting and chemical treatment, the best and most efficient method of controlling growth is by reducing surface erosion and sedimentation.

Sediment acts as a nutrient sink under aerobic conditions. However, when conditions become anoxic, sediments release phosphorous into the water column. Nitrogen can also be released, but the mechanism by which it happens is different. The exchange of nitrogen between sediment and the water column is, for the most part, a microbial process controlled by the amount of oxygen in the sediment. When conditions become anaerobic, the oxygenation of ammonia (nitrification) ceases and an abundance of ammonia is produced. This results in a reduction of nitrogen oxides (NO_x) being lost to the atmosphere.

Sediments can play an integral role in reducing the frequency and duration of phytoplankton blooms in standing waters and large rivers. In many cases there is an immediate response in phytoplankton biomass when external sources are reduced. In other cases, the response time is slower, often taking years. Nonetheless, the relationship is important and must be addressed in waters where phytoplankton is in excess.

2.3.5. Floating, Suspended, or Submerged Matter (Nuisance Algae)

Algae are an important part of the aquatic food chain. However, when elevated levels of algae impact beneficial uses, the algae are considered a nuisance aquatic growth. The excess growth of phytoplankton, periphyton, and/or macrophytes can adversely affect both aquatic life and recreational water uses. Algal blooms occur where adequate nutrients (nitrogen and/or phosphorus) are available to support growth. In addition to nutrient availability, flow rates, velocities, water temperatures, and penetration of sunlight in the water column all affect algae (and macrophyte) growth. Low velocity conditions allow algal concentrations to increase because physical removal by scouring and abrasion does not readily occur. Increases in temperature and sunlight penetration also result in increased algal growth. When the aforementioned conditions are appropriate and nutrient concentrations exceed the quantities needed to support normal algal growth, excessive blooms may develop.

Commonly, algae blooms appear as extensive layers or algal mats on the surface of the water. When present at excessive concentrations in the water column, blue-green algae often produce toxins that can result in skin irritation to swimmers and illness or even death in organisms ingesting the water. The toxic effect of blue-green algae is worse when an abundance of organisms die and accumulate in a central area.

Algal blooms also often create objectionable odors and coloration in water used for domestic drinking water and can produce intense coloration of both the water and shorelines as cells accumulate along the banks. In extreme cases, algal blooms can also result in impairment of agricultural water supplies due to toxicity. Water bodies with high nutrient concentrations that could potentially lead to a high level of algal growth are said to be eutrophic. The extent of the effect is dependent on both the type(s) of algae present and the size, extent, and timing of the bloom.

When algae die in low flow velocity areas, they sink slowly through the water column, eventually collecting on the bottom sediments. The biochemical processes that occur as the algae decompose remove oxygen from the surrounding water. Because most of the decomposition occurs within the lower levels of the water column, a large algal bloom can substantially deplete DO concentrations near the bottom. Low DO in these areas can lead to decreased fish habitat as fish will not frequent areas with low DO. Both living and dead (decomposing) algae can also affect the pH of the water due to the release of various acid and base compounds during respiration and photosynthesis. Additionally, low DO levels caused by decomposing organic matter can lead to changes in water chemistry and a release of sorbed phosphorus to the water column at the water/sediment interface.

Excess nutrient loading can be a water quality problem due to the direct relationship of high TP concentrations on excess algal growth within the water column, combined with the direct effect of the algal life cycle on DO and pH within aquatic systems. Therefore, the reduction of TP inputs to the system can act as a mechanism for water quality improvements, particularly in surface-water systems dominated by blue-green algae, which can acquire nitrogen directly from the atmosphere and the water column. Phosphorus management within these systems can potentially result in improvement in nutrients (phosphorus), nuisance algae, DO, and pH.

2.4. Summary and Analysis of Existing Water Quality Data

Water quality samples have been collected by the USGS on the Kootenai River near Porthill, Idaho, from 1949 through 2001. Water quality sampling was conducted intermittently and consists of temperature, pH, specific conductance, dissolved oxygen, and nutrient data. Idaho DEQ Beneficial Use Reconnaissance Program (BURP) has collected data on a majority of perennial streams within the Idaho portions of the Lower Kootenai and Moyie River Subbains. Data sets collected by BURP surveys include habitat, macroinvertebrates and fisheries information. An extensive temperature study was conducted by DEQ on headwater streams of the basin from 1998-2002. A list of temperature data logger locations and duration and dates of deployment is provided in Appendix C. Numerous studies have been conducted exploring the interaction of hydroelectric power stations and fisheries on the

Kootenai River. Data from these reports were used in this section and other sections through out the TMDL. The above mentioned data are data sets which were used in this section, however, other data may exist.

2.4.1. Flow Characteristics

The USGS has operated 29 gauging stations in the basin from 1925 to 2003. Their locations are shown in Table 9.

The Kootenai River (spelled Kootenay in Canada) originates in southeastern British Columbia. From the headwaters, it flows south into Lake Koocanusa, which straddles the border between British Columbia and Montana. Libby Dam, operated by the U.S. Army Corp of Engineers, impounds the river to form the Lake Koocanusa reservoir. Downstream of the dam, near Libby, Montana, the river turns and flows westward toward Idaho. Near Bonners Ferry, Idaho, the river turns north, and flows again into British Columbia where it enters Kootenay Lake. From the outlet on the west arm of the lake near Nelson, BC, the river flows westward, through several hydropower impoundments, to its confluence with the upper Columbia River near Castlegar, BC.

Table 9. USGS gauging station locations in the Kootenai and Moyie River drainages in Idaho.

Site Number	Site Name	From	To	Number of Recordings
12305500	Boulder Creek near Leonia, ID	1928-06-01	1977-10-05	17447
12305000	Kootenai River at Leonia, ID	1928-03-25	2003-09-30	27583
12306000	Kootenai River at Katka, ID	1928-01-02	1960-09-30	2374
12306500	Moyie River at Eastport, ID	1929-09-01	2003-09-30	27058
12307000	Moyie River at Snyder, ID	1911-03-10	1923-09-30	2930
12307500	Moyie River at Eileen, ID	1925-10-01	1978-11-03	19392
12309000	Cow Creek near Bonners Ferry, ID	1928-05-16	1934-09-30	1365
12309500	Kootenai River at Bonners Ferry, ID	1928-04-01	1960-09-30	11871
12310100	Kootenai River @ tribal hatchery near Bonners Ferry, ID	2002-10-01	2003-09-30	365
12311000	Deep Creek at Moravia, ID	1928-05-01	1971-10-14	15872
12311500	Snow Creek near Moravia, ID	1928-05-08	1934-09-30	1411
12312000	Caribou Creek near Moravia, ID	1928-05-09	1934-09-30	1402
12313000	Myrtle Creek near Bonners Ferry, ID	1928-05-08	2002-09-30	1586
12313500	Ball Creek near Bonners Ferry, ID	1928-05-10	1979-10-04	4580
12315200	Rock Creek near Copeland, ID	1928-05-08	1934-09-30	1440
12315400	Trout Creek near Copeland, ID	1928-05-28	1934-09-30	1244
12315401	Inflow to Kootenai River – branch 1	1988-04-16	1988-04-18	3
12316800	Mission Creek near Copeland, ID	1958-09-01	1981-10-01	8432
12317000	Mission Creek at Copeland, ID	1928-05-09	1934-09-30	1422
12317500	Brush Creek near Copeland, ID	1933-10-01	1934-09-30	226
12318500	Kootenai River near Copeland, ID	1929-05-01	1992-09-30	23164
12318501	Kootenai River, slope/combination	1978-10-02	1979-10-01	282
12319500	Parker Creek near Copeland, ID	1928-05-12	1934-09-30	1303
12320500	Long Canyon Creek near Porthill, ID	1930-10-01	1959-09-30	10592
12320700	Smith Creek below diversion near Porthill, ID	1989-10-01	1992-10-31	1126
12321000	Smith Creek near Porthill, ID	1928-05-12	1960-09-30	11472
12321001	Inflow to Kootenai River – branch 5	1988-04-16	1988-04-18	3
12321500	Boundary Creek near Porthill, ID	1928-05-17	2003-09-30	27174
12322000	Kootenai River at Porthill, ID	1928-10-01	2003-09-30	27393

Table information was obtained from http://nwis.waterdata.usgs.gov.

The largest Idaho tributary systems to the Kootenai River include the Moyie River, Deep Creek, Boundary Creek, and Boulder Creek. Annual discharge in the Idaho tributaries averages 2 cfs per square mile of drainage. The Moyie River drains approximately 192 square miles in Idaho, while the Kootenai River drains approximately 1,140 square miles in Idaho and a total area of 13,700 square miles before leaving Idaho near Porthill. The

Kootenai River has a mean annual discharge of nine million acre-feet and a flow rate at its mouth of just under 30,650 cubic feet per second (cfs).

As the Kootenai River passes through Idaho it gains a total of 1,956 cfs. Entering Idaho near Leonia, the Kootenai River has an annual flow of 13,917 cfs. The USGS has operated a gauging station (12305000) at this location since 1928. When the Kootenai River enters back into Canada, near Porthill, Idaho, its mean annual discharge is 15,874 cfs and has been gauged since 1928 (12322000). Peak discharge of the Kootenai River at Porthill occurred on June 1, 1954 at 125,000 cfs, and minimum flow was recorded on February 8, 1936, at 1,380 cfs.

A gauging station on the Moyie River near Eastport, Idaho (12306500) has been in operation since September 1, 1929. Eastport is located near the Idaho-Canada border and is approximately 20 miles upstream from the confluence with the Kootenai River. The annual discharge hydrograph illustrates a spring snow melt event occurring from April through June dominating the stream discharge pattern. A dominating spring snow melt pattern is common of all hydrographs in this region. The lowest flows occur from August through September. The mean annual discharge of the Moyie River at this location is 692 cfs.

The Eileen, Idaho gauging station (12307500) is located approximately 15 miles downstream from Eastport, and was in operation from August 1, 1925 to November 3, 1978. The mean annual discharge of the Moyie River at this location, for the period of record, was 886 cfs, a net increase of 192 cfs from the Eastport gauging station. This increase is attributed to headwater streams and ground water inflow entering the river throughout its reach. Peak discharge of the Moyie River at Eileen occurred on May 21, 1956 at 9,860 cfs, and minimum flow was recorded on January 2-8, 1937 at 50 cfs.

Several main tributaries enter the Kootenai River upstream of the confluence with the Moyie River. Long Canyon Creek (30 square miles) joins the Kootenai River approximately two miles south of the Canadian border. Long Canyon Creek was gauged by the USGS (12320500) from October 1930 through September 1959 and in that period contributed an annual flow of 63 cfs. Boundary Creek (85 square miles) near Porthill empties into the Kootenai River in Canada. Boundary Creek has been gauged in Idaho since 1928 (12321500), offering a long-term record, and adds a mean annual flow of 201 cfs.

Water quantity trends were analyzed in the Lower Kootenai and Moyie Subbasins by determining the residual flows of the Kootenai River at Porthill, Idaho, Moyie River at Eastport, Idaho and Boundary Creek near Porthill, Idaho. These selected locations represent stream flows from within the basin. Residual flow was calculated by subtracting the actual discharge for each date from the average daily stream flow. This calculation highlights any trends in the basin of water quantity gain or loss. Values were plotted and a trendline was applied to help determine water quantity. Stream discharge records indicate that water quantity is variable. Presently the basin is experiencing a period of gradual decline in water quantity. Periods of water quantity loss are typically followed by periods of water quantity gain.

The Kootenai River is impounded twice before its confluence with the Columbia River. The Libby Dam near Libby, Montana was constructed in 1973 for flood protection and hydroelectric power production. Discharge from the Libby Dam can range from 3,990 cfs to 27,015 cfs depending on power demand. Prior to the construction of the Libby Dam the

Kootenai River's annual discharge at Porthill, Idaho was 16,064 cfs. After the completion of the dam, the river's mean annual discharge was regulated to 15,580 cfs, an approximate difference of 484 cfs. Major flooding events in the Kootenai River valley occurred in 1916, 1948, and 1956. With the completion of the Libby Dam discharge has become more consistent, resulting in higher low flows and lower high flows, consequently the threat from overbank flooding has become minimal.

The Corra Linn Dam, the second impoundment of the Kootenai River, is located 16 miles upstream from the Columbia River and was constructed in 1931, creating Kootenay Lake. The Corra Linn Dam was constructed to produce hydroelectric power and has an average annual discharge of 27,965 cfs. From the Corra Linn Dam, the Kootenai River passes through five hydroelectric dams before emptying into the Columbia River. The Kootenai River is the second largest tributary to the Columbia River in volume and the third largest in drainage area.

2.4.2. Water Column Data

Water samples have been collected by the USGS on the Kootenai River near Porthill, Idaho since 1949. Prior to 1998 water quality data collected at this location consisted of temperature and specific conductance. From 1998 through 2001, pH, dissolved oxygen levels, and nutrient data were also collected intermittently. BURP data has been collected in multiple watersheds during the summer and early fall, outlining habitat and biological parameters. DEQ has collected temperature data, using data loggers, at 70 sites in the Lower Kootenai and Moyie River Subbasins.

Water quality samples collected near Porthill, Idaho on the Kootenai River are displayed in Table 10. Water quality data collected at the Porthill gauge station (12322000) form 1998 through 2001 indicates good water quality, displaying no exceedance of water quality standards. It is difficult to draw an accurate conclusion of tributaries to the Kootenai River based on the data gathered at the Porthill gauging station (12322000). BURP data gathered in the tributaries to the Kootenai River were analyzed to determine the status of beneficial uses.

Table 10. Water quality samples taken at Porthill, Idaho gauge station (12322000).

Sample Date	Water Temp (ºC)	Inst. Discharge (cfs)	Specific Conduct (µs/cm) @ 25ºC	pH (standard Units)	Nitrogen, Ammonia Dissolved (mg/L as N)	Nitrogen, Ammonia + Organic Total (mg/L as N)	Nitrogen, Nitrate + Nitrite Dissolved (mg/L as N)	Phosphorus Total (mg/L as P)	Phosphorus Ortho Dissolved (mg/L as P)	Dissolved Oxygen (mg/L)
01/09/96	4.5	29800	226							
03/07/96	2.5	17000	221							
04/30/96	7	30300	197							
05/30/96	13	47700	161							
07/29/96	18	10400	198							
04/13/98	5.7	9310	164	7.5	0.04	0.10	0.06	0.01	0.01	11.5
05/28/98	10	44800	147	7.6	0.06	0.26	0.08	0.07	0.01	10.4
06/23/98	13.5	26700	202	8.1	0.11	0.38	0.05	0.23	0.01	10.6
07/15/98	16.5	9190	198	8.1	0.05	0.10	0.09	0.01	0.02	10
08/26/98	14.4	17600	229	8.3	0.03	0.10	0.10	0.01	0.01	12.3
10/01/98	13.1		231	8.1	0.02	0.10	0.17	0.05	0.01	9.8
04/04/01	5.5	5270	239	8	0.017	0.19	0.063	0.006	0.007	3.2
05/22/01	9.6	10500	122	7.9	0.002	0.04	0.046	0.007	0.007	7.3
06/27/01	16.2	5940	193	8.1	0.009	0.08	0.014	0.006	0.007	9.1
07/30/01	17.9	6600	235	7.6	0.002	0.11	0.025	0.005	0.007	8
08/27/01	18	6460	241	7.9	0.004	0.10	0.026	0.004	0.007	8.7
09/24/01	15.9	6450	245	8.4	0.008	0.11	0.009	0.005	0.007	9.4

2.4.2.1. Dissolved Oxygen

Dissolved oxygen minimum standards require 6 mg/L dissolved oxygen to support cold water aquatic life and 5 mg/L intergravel and 6 mg/L surface dissolved oxygen levels to support salmonid spawning, No stream segment in the Lower Kootenai or Moyie River Subbasins are on the 1998 §303(d) list for dissolved oxygen limitations. Dissolved oxygen standards are satisfied in the Lower Kootenai and Moyie River Subbasins.

2.4.2.2. pH

Blue Joe Creek, from the headwaters to the Canadian border, is listed for pH exceedance (When pH is higher than our upper criteria (9.5) ore less than our lower criteria (6.5).. Cold water aquatic life use and salmonid spawning beneficial use support requires a pH of between 6.5 and 9.5.

2.4.2.3. Metals

Blue Joe Creek, from the headwaters to the Canadian border, is currently listed on the 1998 §303(d) list for metals exceedances. The specific metals of concern in Blue Joe Creek are lead, zinc and cadmium. The major sources for metals in Blue Joe Creek occur from seepage and leaching of tailings piles from the Idaho Continental Mine's tunnel number 5 (Mitchell 2000). The Continental Mine is located approximately five miles above Blue Joe's confluence with Boundary Creek, and was active from the 1890s to the 1950s. High discharge events have transported many of the tailings downstream.

Environmental cleanup activities have been completed and Blue Joe Creek is considered recovering. More details are in the Key Findings portion of the Executive Summary, and in section 2.4.5.

The toxicity of dissolved metals in the water column is dependent on the hardness (calcium carbonate (mg/L) in the water) of the water in question. Toxicity of metals to aquatic life increases as hardness decreases. For this reason hardness based water quality criteria are most stringent at low hardness levels. A stream's water hardness value can be related to flow, as flow decreases hardness increases. This means that as flow rates decrease water quality criteria for metals increase. Idaho sets a minimum hardness to be used in calculating the criteria at 25 mg/L (Idaho Water Quality Standards).

Idaho water quality standards for allowable metals concentrations have two parts. Chemical criteria are defined in terms of concentrations and the frequency and duration of allowable exceedances of these concentrations. Concentrations are usually defined as maximum and average concentrations. A criterion maximum concentration (CMC) "acute" criterion is the one hour average concentration not to be exceeded more than once every three years. A criterion continuous concentration (CCC) "chronic" criterion is the four-day average concentration not to be exceeded more than once every three years. The following hardness based equations have been established in the state of Idaho water quality standards:

- Dissolved Cadmium Criteria:

Criterion Continuous Concentration

(1.101672-[ln(hardness)(0.041838)])*(exp[0.7852(ln(hardness))-3.490])

Criterion Max Concentration

(1.136672-[ln(hardness)(0.041838)])*(exp[1.0166(ln(hardness))-3.924])

- Dissolved Lead Criteria:

Criterion Continuous Concentration

(1.46203-[ln(hardness)(0.145712)])*(exp[1.273(ln(hardness))-4.705])

Criterion Max Concentration

(1.46203-[ln(hardness)(0.145712)])*(exp[1.273(ln(hardness))-1.46])

- Dissolved Zinc Criteria:

Criterion Continuous Concentration

0.986exp[0.8473(ln(hardness))+0.884]

Criterion Max Concentration

0.978exp[0.8473(ln(hardness))+0.884]

Hardness values in the Kootenai River vary with geographic location, time of year, and discharge. The overall mean hardness of the Kootenai River is 93 mg/L (measured by Bauer in 1998, Kootenai River Water Quality Study). Seasonal low hardness values occurred in May with an overall average hardness value of 70 mg/L. Metal toxicity is dependent on the hardness of the river, so 70 mg/L should be used as the overall value when calculating criteria. Hardness values of the Moyie River are considerably lower than the Kootenai River with an overall mean of 18.5 mg/L (Bauer 1998).

Hardness values for tributaries to the Kootenai River are dramatically lower than those measured in the Kootenai River. The overall median hardness value for the Kootenai River tributaries is 15 mg/L (Bauer 2000). Some tributaries in the subbasin exhibit consistently higher hardness values, but using the lower value of 15 mg/L is more conservative (protective) of aquatic resources (Bauer 2000). When determining the toxicity of the metal concentrations in a stream it is important to evaluate each stream individually, associating a hardness value for each stream. Based on these hardness levels and available data, only Blue Joe Creek was found to exceed Water Quality Standards.

2.4.2.4. Nutrients

No stream segments in the Lower Kootenai and Moyie Subbasins are listed for nutrients. Water samples collected at USGS gauge station 12322000 near Porthill, Idaho indicate no exceedances of water quality criteria for nutrients. Idaho water quality narrative criteria states that “Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses.” No obvious sources of nutrient impairment are noted in the subbasins. Snyder and Minshall (1996) and Richards (1997) have suggested that the Libby Dam may act as a nutrient trap, resulting in low nutrient values in the Kootenai River. However, this may not explain the low levels of nutrients in the river, as tributaries in Idaho also appear to be low in nutrients. It has been speculated that the geologic setting may be a poor nutrient producer.

2.4.2.5. Temperature

Deep Creek and Boundary Creek are EPA temperature additions to the 1998 §303(d) list. DEQ has monitored temperature in the subbasin using temperature data loggers, during the time frame that captures the hottest period of the year when stream temperatures are likely to exceed standards.

Two temperature loggers were deployed on Deep Creek from July through October in 1998 and in 2000, and from May through October in 2001. A full season of Deep Creek temperatures taken near Ruby Creek in 2000 (Figure C-5 in Appendix C) shows violations of cold water aquatic life criteria 26% of the time, and violations of spring and fall salmonid spawning criteria over 90% of the time. During roughly the same time period (late July to early September) in 2000, temperatures recorded by temperature data loggers in nearly the same place in Deep Creek are shown in Figures C-6 through C-10 in Appendix C. Temperature data loggers were placed approximately 0.5m from each other, thus they represent replicates of each other. There is little difference among the data from these loggers. All temperature data from the Deep Creek loggers show violations of fall salmonid spawning criteria 100% of the time. It is not known how much of Deep Creek's temperature profile is the result of discharge from McArthur Lake, which is a shallow, warm water lake.

From July through October in 1998, 2000 and 2001 two temperature recorders were deployed in Boundary Creek. A full season of Boundary Creek temperatures taken at the lower end near the United States Geological Survey (USGS) gage station revealed that cold water aquatic life criteria were met in 2000, but spring salmonid spawning criteria were violated 27% of the time and fall salmonid spawning criteria were violated as much as 81% of the time. Partial season recordings (during 1998 and 2001) of Boundary Creek temperature (Figures C-2 through C-4 in Appendix C) also show violations of fall salmonid spawning criteria to a similar degree (50-60% of the time), including at one upper site where Boundary Creek enters Idaho from Canada (Figure C-2 in Appendix C). Temperature differences between the upper site (Figure C-2) where Boundary Creek enters Idaho (3,400 ft elevation) and the lower site (Figure C-3) near the USGS gage (1,800 ft elevation), during the same time period in 1998, show an average difference of 1.6^{o}C (with a range of 3.8^{o} to -0.6^{o}C).

2.4.3. Biological and Other Data

Stream macroinvertebrate index (SMI), stream fish index (SFI) and stream habitat index (SHI) scores for streams in the Lower Kootenai and Moyie River Subbasins are compiled in Table 11. As described in DEQ's WBAG II (Grafe et al. 2002), indices are based on the Northern Mountain Ecoregion. A minimum of two indices are required to make a support determination. An average value of 2 or greater generally indicates support of cold water use, and a value lower than two indicates nonsupport. At least two indices must be available for assessment. Scoring criteria is outlined in Table 12.

Table 11. BURP Sites and Index Scores for Lower Kootenai and Moyie River Subbasins.

Stream Name	BURP ID	ASSESSMENT UNIT	Stream Macro-invertebrate Index	Stream Fish Index	Stream Habitat Index
Ball Creek	1998SCDAB043	ID17010104PN011_02	64.72	64.80	83.00
Blue Joe Creek	1995SCDAA070	ID17010104PN004_02	46.36	No Fish	63.00
Boulder Creek	1995SCDAA074	ID17010104PN032_03	37.55	NA	37.00
Boulder Creek	1994SCDAA057	ID17010104PN033_03	80.27	82.14	45.00
Boulder Creek	1995SCDAA073	ID17010104PN033_03	35.47	NA	59.00
Boundary Creek	1995SCDAB043	ID17010104PN002_02	44.52	82.92	52.00
Boundary Creek	1999SCDAA011	ID17010104PN002_02	34.65	NA	76.00
Boundary Creek	1999SCDAA012	ID17010104PN002_03	45.09	25.12	49.00
Boundary Creek	1995SCDAB044	ID17010104PN002_03	28.33	NA	49.00
Boundary Creek	1999SCDAA013	ID17010104PN002_03	39.67	NA	75.00
Brown Creek	1995SCDAB046	ID17010104PN027_03	36.80	NA	48.00
Canuck Creek	1998SCDAB058	ID17010105PN007_02	61.46	80.00	62.00
Canuck Creek	1994SCDAA058	ID17010105PN007_02	77.02	95.00	64.00
Caribou Creek	1994SCDAA033	ID17010104PN017_02	54.99	91.48	26.00
Cascade Creek	1998SCDAB044	ID17010104PN014_02	63.04	NA	80.00
Copper Creek	1998SCDAB059	ID17010105PN006_02	58.80	NA	56.00
Cow Creek	1995SCDAB041	ID17010104PN006_02	50.75	66.08	66.00
Cow Creek	1998SCDAB053	ID17010104PN030_03	48.95	41.91	50.00
Curley Creek	1998SCDAB054	ID17010104PN035_03	21.70	15.49	40.00
Deep Creek	1995SCDAA072	ID17010104PN019_04	40.50	46.41	40.00
Deep Creek	1995SCDAA071	ID17010104PN022_03	32.65	NA	36.00
Deer Creek	1994SCDAA059	ID17010105PN004_03	54.48	98.42	59.00
Deer Creek	1998SCDAB062	ID17010105PN004_03	82.61	NA	70.00
East Fork Meadow Creek	1995SCDAB042	ID17010105PN012_02	67.14	41.19	69.00
Fall Creek	1998SCDAB050	ID17010104PN021_03	30.01	45.05	44.00
Gillon Creek	1998SCDAB060	ID17010105PN009_02	60.21	72.72	64.00
Grass Creek	1998SCDAB033	ID17010104PN003_02	66.37	NA	83.00
Grass Creek	1998SCDAA016	ID17010104PN003_03	70.79	57.14	75.00
Grass Creek	1994SCDAA034	ID17010104PN003_03	47.51	73.45	29.00
Kreist Creek	1997SCDAA020	ID17010105PN005_02	62.75	NA	72.00
Long Canyon Creek	1998SCDAA015	ID17010104PN008_02	51.32	54.85	82.00
Long Canyon Creek	1994SCDAA029	ID17010104PN008_02	50.85	72.69	43.00
Meadow Creek	1994SCDAA012	ID17010105PN012_03	62.20	61.96	50.00
Middle Fork Boulder Creek	1999SCDAA010	ID17010104PN033_02	65.69	NA	87.00
Mission Creek	1994SCDAA035	ID17010104PN040_03	52.48	88.86	66.00
Myrtle Creek	1994SCDAA032	ID17010104PN013_03	45.68	72.18	46.00

Stream Name	BURP ID	ASSESSMENT UNIT	Stream Macro-invertebrate Index	Stream Fish Index	Stream Habitat Index
Myrtle Creek	1998SCDAB047	ID17010104PN013_03	64.13	NA	75.00
Parker Creek	1994SCDAA030	ID17010104PN009_02	61.70	99.21	25.00
Placer Creek	1994SCDAA011	ID17010105PN002_02	75.09	80.28	69.00
Raymond Creek	1998SCDAA012	ID17010101PN001_02	66.58	88.81	80.00
Rock Creek	1998SCDAB041	ID17010104PN037_02	34.55	NA	67.00
Round Prairie Creek	1994SCDAA010	ID17010105PN010_02	46.46	52.81	50.00
Round Prairie Creek	1997SCDAA021	ID17010105PN010_02	28.76	NA	39.00
Ruby Creek	1997SCDAA019	ID17010104PN020_02	66.46	NA	74.00
Ruby Creek	1994SCDAA037	ID17010104PN020_03	56.85	75.09	48.00
S Callahan Creek	1994SCDAA056	ID17010101PN003_03	80.06	82.92	57.00
Skin Creek	1998SCDAB063	ID17010105PN003_02	76.53	NA	78.00
Smith Creek	1994SCDAA036	ID17010104PN005_04	65.93	NA	49.00
Smith Creek	1998SCDAB042	ID17010104PN007_03	62.00	47.69	73.00
Snow Creek	1995SCDAA069	ID17010104PN016_02	60.21	58.29	52.00
Snow Creek	1995SCDAA068	ID17010104PN016_03	53.93	70.58	60.00
Trail Creek	1998SCDAB052	ID17010104PN026_03	65.49	NA	48.00
Trout Creek	1994SCDAA031	ID17010104PN010_03	46.88	90.27	60.00
Trout Creek	1998SCDAB055	ID17010104PN010_03	83.31	NA	85.00
Twentymile Creek	1995SCDAB045	ID17010104PN028_02	63.42	82.34	60.00
Wall Creek	1996SCDAA011	ID17010105PN012_02	56.78	NA	75.00

Table 12. SMI, SFI and SHI scoring criteria

Condition Category	SMI (Northern Mountains)	SFI (Forest)	SHI (Northern Rockies)	Condition Rating
Above the 25th percentile of reference condition	≥65	≥81	≥66	3
10th to 25th percentile of reference condition	57-64	67-80	58-65	2
Minimum to 10th percentile of reference condition	39-56	34-66	<58	1
Below minimum of reference condition	<39	<34		Minimum Threshold

2.4.4. Status of Beneficial Uses

The WBAG II (Grafe et al. 2002) describes DEQ's methods for determining beneficial use support. The only uses considered in this report are the aquatic life beneficial uses, including cold water aquatic life, salmonid spawning, and bull trout where appropriate. Cold water aquatic life use support is determined by water quality criteria compliance and multimetric indexes calculated from macroinvertebrate, fish, and physical habitat monitoring data. Each index includes several characteristics to gauge ecosystem health from BURP compatible data. The multimetric index value is a summation of the individual metrics that respond to environmental degradation. The stream macroinvertebrate index (SMI), stream fish index (SFI), and stream habitat index (SHI) scores for each site are then assigned a condition rating based on percentiles of their respective reference conditions. Condition ratings from the available indexes are then averaged to give an indication of the overall cold water aquatic life use support status. In addition to looking at biological indices, support for salmonid spawning and bull trout aquatic life uses is determined through numeric temperature criteria compliance.

The primary external factors impacting the Kootenai River basin fish and wildlife resources come from the mainstem Columbia River federal hydropower operations, which profoundly influence dam operations as far upstream as headwater reservoirs. Dam operations affect environmental conditions in the reservoirs upstream and rivers downstream from Libby Dam. The abundance, productivity, and diversity of fish and wildlife species inhabiting the subbasin are dependent on their immediate environment that ebbs and flows with river management.

Mainstem Columbia River operations affect native fish and wildlife in the following ways:

- Unnaturally high flows during summer and winter negatively impact resident fish.
- Summer flow augmentation causes reservoirs to be drafted during the biologically productive summer months. This impacts productivity in the reservoirs.
- Drafting the reservoirs excessively prior to receiving the January 1 inflow forecast places the reservoirs at a disadvantage for reservoir refill. This is especially important during less-than-average water years.
- Flow fluctuations caused by power generation requirements, flood control, or fish flows create a wide varial zone in the river (subject to periodic air exposure and inundation), which becomes biologically unproductive.
- The planned reservoir-refill date of June 30, in the National Oceanic and Atmospheric Administration (NOAA) Fisheries Biological Opinion, will cause the dam to spill in roughly the highest 30% of water years. This is because inflows remain above turbine capacity into July on high years. That means the reservoirs fill and have no remaining capacity to control spill, which causes gas super-saturation problems.
- Flow fluctuations caused by power generation requirements, flood control, or fish flows cause sediments to build up in river cobbles. Before dams were built, these sediments normally deposited themselves in floodplain zones that provided the seedbeds necessary for establishment of willow, cottonwood, and other riparian plant communities. Young cottonwood stands are needed to replace mature stands that are being lost to natural stand aging as well as adverse human activities such as hardwood logging and land clearing.

2.4.5. Conclusions

In-stream and aerial water temperature data show exceedances of temperature criteria for bull trout and salmonid spawning throughout the basin. Higher order tributaries (larger streams) also exceed cold water aquatic life temperature criteria. The limited distribution of bull trout in the basin may reflect the insufficient availability of cold water necessary to support bull trout life requisites for fall spawning and summer rearing. All of the water bodies in the Lower Kootenai and Moyie Subbasins are therefore recommended to be included in future temperature TMDLs for the Lower Kootenai and Moyie River Subbasins.

Sediment impacted streams are more difficult to identify. The lack of numeric criteria for sediment requires a more direct measure of beneficial use support. When comparing sediment loads to macroinvertebrate index scores, scores generally fall below the full support threshold when sediment loads exceed 50% of background. Waters that are §303(d) listed for sediment and have sediment loads in excess of 50% of background include Cow Creek, Deep Creek, and the Moyie River. These waters and their tributaries are to be included in the sediment TMDL. Waters that were not listed on the §303(d) list for sediment, but produce sediment in excess of 50% of background are recommended to be evaluated in the next assessment cycle.

Water quality criteria for metals were exceeded in Blue Joe Creek at the time of this assessment. Because of water quality improvement projects that have already been implemented, it is expected that Blue Joe Creek will meet all designated uses within a reasonable timeframe. Metals TMDLs are therefore deferred and listing as category 4b in Idaho's next Integrated Report is recommended. It is also recommended that additional data be collected in Blue Joe Creek for determination of compliance with the pH criteria.

2.5. Data Gaps

Many of the waters in the Upper Kootenai, Lower Kootenai, and Moyie River Subbasins are classified as "unassessed." Streams that have not had BURP monitoring include Smith, West Fork Smith, Cutoff, Bear, Lost, Dodge, South Fork Dodge, Curley, Kingsley, Fleming, Bane, Rock, Mission, Little Hellroaring, and Miller Creeks. Continued BURP monitoring will eventually close this data gap and allow for better spatial representation of biological information within the basin.

The major data gap in temperature monitoring is the lack of temperature data for the entire length of stream. Most temperature data recorders were deployed near or at the mouths of the streams. In order to make a more accurate assessment, a temperature profile for the entire watershed should be prepared. Further deployment of data loggers and improved deployment protocols will eventually reduce this data gap.

Data gaps in sediment pollution monitoring stem from the lack of in-stream sediment measurements and information outlining sediment transport for the basin. Nonpoint sources have been modeled rather than measured. In-stream monitoring of sediment load would be of value. Such monitoring is expensive and it is unlikely that this data gap will be filled. Model results continue to be the best available information at this time.

When modeling sediment loading to watersheds, cumulative watershed effects (CWE) road scores were used when available. Idaho Code Section 38-1303 (17) defines cumulative watershed effects as "…the impact on water quality and/or beneficial uses which result from the incremental impact of two or more forest practices. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time." The CWE methodology is designed to examine conditions in the watershed surrounding a stream first, and then in the stream itself. It then attempts to identify the causes of any adverse conditions. Finally, it helps to identify actions that will correct any identified adverse conditions.

Not all watersheds in the basin had applicable CWE road scores associated. Further development of this coverage would help to more accurately define sediment problems. As with BURP monitoring, this data gap will most likely be filled in the future.